Air Force SBIR Impact

Development of Simulation Models for Unmanned Aerial Vehicles

Company:
Bihrle Applied
Research Inc.

Location:
Jericho, NY

Employees:
12

President:
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Project Officer:
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Air Force Requirements:

As the Air Force's reliance on Unmanned Aerial Vehicle (UAV) and Unmanned Combat Aerial Vehicles (UCAV) increases, so do its simulation and modeling requirements. Operations of UAV and UCAV groups will require close formation flight to gain tactical advantage, attain performance benefits, and/or perform in flight refueling. Since human operators are to be located in remote air or ground stations, advanced flight control algorithms need to be developed. To facilitate the development of robust control laws and reduce project risk, the Air Force requires advanced simulation and modeling capabilities for air vehicles in close formation.

SBIR Technology:

Bihrle Applied Research Inc. (BAR) won Phase I and Phase II SBIR contracts to improve the state of the art in developing simulations of air vehicles flying in close formation. In this effort, BAR is addressing Air Force needs in two areas, flight model development and simulation tools.

The development of models for close formation flight has historically been based on computational aerodynamics. While this approach is good for preliminary estimates, it results in over-simplification of the characterizing of aerodynamic phenomena. This over-simplification often leads to the development of low-fidelity modeling. During its Phase II work, BAR developed test techniques, apparatus, and

data acquisition software that can be used during wind tunnel tests to measure aircraft aerodynamic characteristics while in close formation. Data from wind tunnel tests utilizing this improved technology can be used to refine preliminary computational estimates and refine algorithms. It can also be implemented directly into simulation models.

The second issue BAR addressed during Phase II is the need for advanced simulation tools for close formation flight. Based on its D-Six PC-Based simulation environment (a product of a SBIR Phase I in 1995), BAR is developing a comprehensive simulation capability that allows users to load multiple independent simulations into a single application. This capability allows the Air Force to develop a single flight model and reuse it during a single simulation session. Using two (or more) simulations loaded into the environment, an engineer may apply a global control algorithm to a simulated formation flight scenario. Until now, development sessions like these have required multiple simulations running on multiple computers or a single complex simulation structure. The advanced simulation capability being developed by BAR will greatly simplify the complex task of modeling multiple vehicles, while requiring less development time for engineers.

Company Impact:

Bihrle Applied Research was awarded a sub-contract from The Boeing Company, St Louis, MO, to provide wind-tunnel data and formation flight model information in support of an ongoing effort with NASA Dryden Flight Research Center to develop autonomous formation flight capability.

The simulation capability developed during the Phase II effort will serve as the foundation of a next generation version of the commercially available D-Six Simulation environment. This software is currently being marketed and will be available to the public in early 2002. Several UAV developers that are now using D-Six to support their UAV developmental simulation exercises have expressed substantial interest in the new software's capabilities. These include the Air Force's Automated Aircraft Collision Avoidance System (Auto ACAS) Program, the Integrated Tactical Aircraft Control (ITAC) Program, and the X-45 Program.

Company Quote:

"With Bihrle Applied Research's emphasis on UAV and UCAV developmental support, the evolution of the test and simulation capabilities provided by the SBIR program will further strengthen the company's position in this expanding market."

Jack Ralston
Vice President of Engineering